NEWEST SCIENTIFIC DISCOVERIES & REMARKABLE FACTS

16½-INCH GUN CRUMBLES GREAT, MODERN FORTS WITH SINGLE SHOT!

42-Centimeter German Cannon Weighs 100 Tons, Is Marvel of Age

UNDOUBTEDLY the most astonishing development of the great European war, which has been replete with surprises, is the mammoth forty-two centimeter gun with which the Germans have been able to batter their way through the most modern fortifications hitherto believed to be impregnable.

In the early days of the war it was asserted that the forty-two centimeter German gun was a myth and that stories concerning that terrible engine of war were circulated only to spread consternation among the allies.

However, with the fall of Namur and Antwerp the allies awakened to the fact that the forty-two centimeter gun, which is of about sixteen and one-half inches caliber, was a grim reality. Up to that time it was asserted by the allies that the heaviest gun employed by the Germans was the twenty-eight centimeter, and photographs of this weapon were pointed out as pictures of the forty-two centimeter. After the forty-two centimeter gun became an acknowledged fact there was a tendency on the part of some military experts to consider this gun as similar in design and construction to the twenty-eight centimeter, or eleven inch gun, differing only in size.

It is now known, however, that the two guns are dissimilar in design and in nearly every detail of construction. When the war started Germany had eight of these enormous sixteen and one-half inch howitzers. One of these guns was sent to Liege when the other siege guns failed to make an impression on the great forts there. It was served by a gun crew from the Krupp plant and the first six shots practically shattered one fort each. The German war office, after demonstrating the terrible effectiveness of these giant engines, ordered the other seven forty-two centimeter guns hurried to Namur. Four hours after these guns had been put in action at Namur they had reduced the great forts there to a mass of dust.

This great gun hurls a shell five feet in length, and weighing 1,650 pounds, as compared with the Russian shell of 800 pounds, which was the largest projectile fired by a siege gun previous to the advent of the giant German howitzer. At an elevation of 45 degrees the forty-two centimeter gun can hurl a shell a distance of nine miles.

The short barrel of the gun is mounted on a heavy cradle of girders with a length over all of fifty-nine feet. The cradle terminates at either end in a platform mounted on a six-wheeled bogie truck, the bogies being necessary to enable the gun being taken around short curves.

The actual gun carriage is carried on a live roller ring of nine feet diameter, which is rotatable by hydraulic power. An arrangement of hydraulic pistons controls the elevation. The hydraulic pumps are driven by a small internal combustion engine fitted with a carburetor which allows it to be run by either petrol or paraffin. This engine is mounted on the forward platform and is coupled to a dynamo of the series wound type which is in series with the primary of an induction coil fitted with mechanical interrupter. The secondary of this coil forms the firing circuit and is taken to the breech of the gun.

The gun crew stands fifty yards away when the circuit is closed and the gun fired, so tremendous is the atmospheric disturbance at the moment of firing.

Before firing the gun the wheels of the bogies are locked by hydraulic brakes, hydraulic buffers are prepared to take up the recoil and hydraulic jacks are lowered from the cradle to the ground to take the weight off the pins of the bogie pivots.

On the after platform is a light but strong crane provided with a set of differential blocks for lifting the shell out of the ammunition wagon and placing it on the loading shelf from which it slides into the breach of the gun.

The siege train consists of a great locomotive with a coal tender of large capacity, the gun carriage, an armored ammunition wagon and a sleeping car for the gun crew, who are all trained engineers from the Krupp plant.

The weight of the gun and carriage is about 100 tons and the weight of the rest of the equipment is three times that amount.

The forty-two centimeter gun is far more cumbersome than any other ever built, and from the nature of its construction, the inefficient method of loading and the enormous weight of the shell, the firing process is long and only a few rounds can be fired in one day. In fact, the gun has many serious defects and because of its great weight it cannot be carried for any considerable distance with an invading army. The gun is too heavy to be transported on any temporary light railway, and can only be moved on a railway of standard gauge and construction. For the same reason it is impossible to move the gun over any temporary bridge, such as must often be constructed in time of war, and it is impossible to haul it over any highway. Thus should the railways or bridges be destroyed within a radius of ten miles or so of any threatened position, the forty-two centimeter would be made harmless as a weapon of offense.

Like all guns of great caliber, this German monster quickly deteriorates and the barrel and mounting need frequent attention at the hands of engineers. After a few shells have been fired the gun must either be scrapped or sent back to the Krupp works at Essen for overhauling. In fact, the guns became so strained in the siege of Namur that it was necessary to ship them back to the Krupp plant for repairs. Judging from the damage done by these guns at Namur the charge in the shell is either melinite or picric acid. The wall of the shell is very thin and the charge of the explosive is abnormally high in consequence.

Other than in the weight of the shell and the consequent larger area of destruction, the gun is no more superior to the twenty-eight centimeter used by the Austrians and Germans, which fires a shell weighing 750 pounds with comparative rapidity, and can be transported over ordinary roads.

Here is how the principal howitzers being used in the European war compare:

German....	42 cm. howitzer	100 tons
German....	28 cm. howitzer	28 tons
Russian....	31 cm. howitzer	28 tons
Austrian....	28 cm. howitzer	22 tons
French.....	27 cm. howitzer	22 tons

The German eleven-inch mortar also marks a great stride in power and weight, and particularly in mobility, over any other mobile artillery yet constructed. The outstanding feature of this great mortar is that it is so mounted that the gun and its carriage can be hauled either by motor or by horsepower at a speed approximating that of the lighter siege artillery, and that when it has reached the designated position, it takes but a short time to have the gun in battery, ready for the attack.

The barrel of the gun is made of steel, and it consists of the inner tube and an outer jacket, the total length of the gun being eleven feet. The breech is opened and closed by turning a handle through a horizontal arc for about 135 degrees; and a safety device operated by hand is provided which prevents premature firing or accidental opening of the breech. In spite of the fact that the breech mechanism weighs 1,100 pounds, the construction is such that the opening and closing of it can be effected easily with one hand and in a few seconds' time.

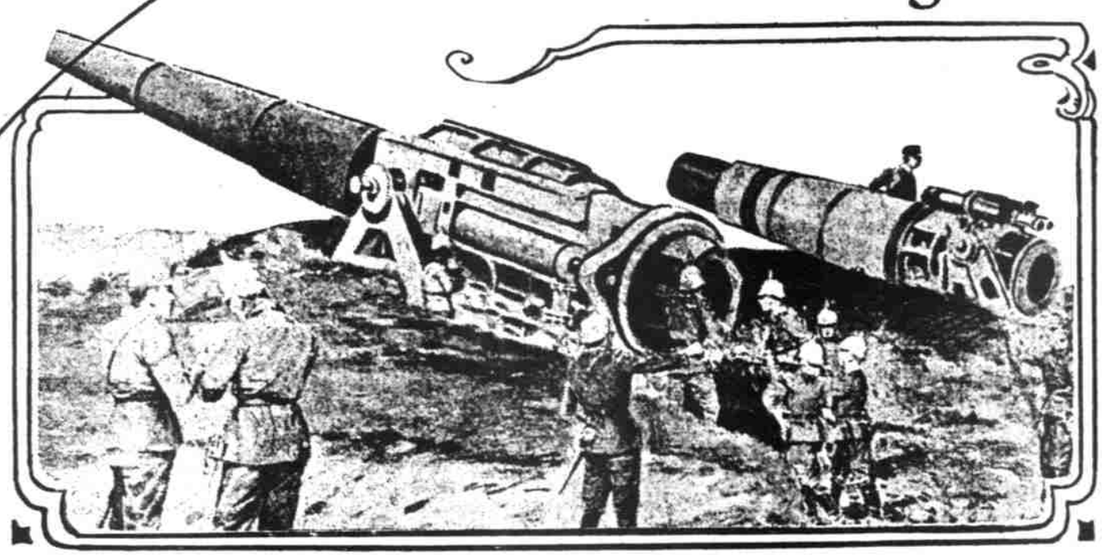
The gun is transported on two separate vehicles, each of which can be hauled by a single motor truck. During transportation one unit consists of the gun carriage, slide, recoil cylinders, trail, and permanent axle and wheels, the last named being fitted with broad flat feet after the manner of the Diplock pedrail. The after end of the trail during transportation is mounted upon a pair of wheels. The gun itself is transported upon a carriage upon which it is placed in such a position that the majority of the weight will come upon a pair of pedrail wheels.

To mount the gun when it has reached its assigned place, all that is necessary is to back up the section carrying the gun against the section constituting the mount, and then, by means of wire cables draw the gun forward into the sleeve and bolt the lug to the piston rod of the recoil cylinder. The gun transporting section is then drawn away, the trail is lowered to the ground and the gun is ready for firing.

Exact Sizes of the Mouths of World's Greatest Guns

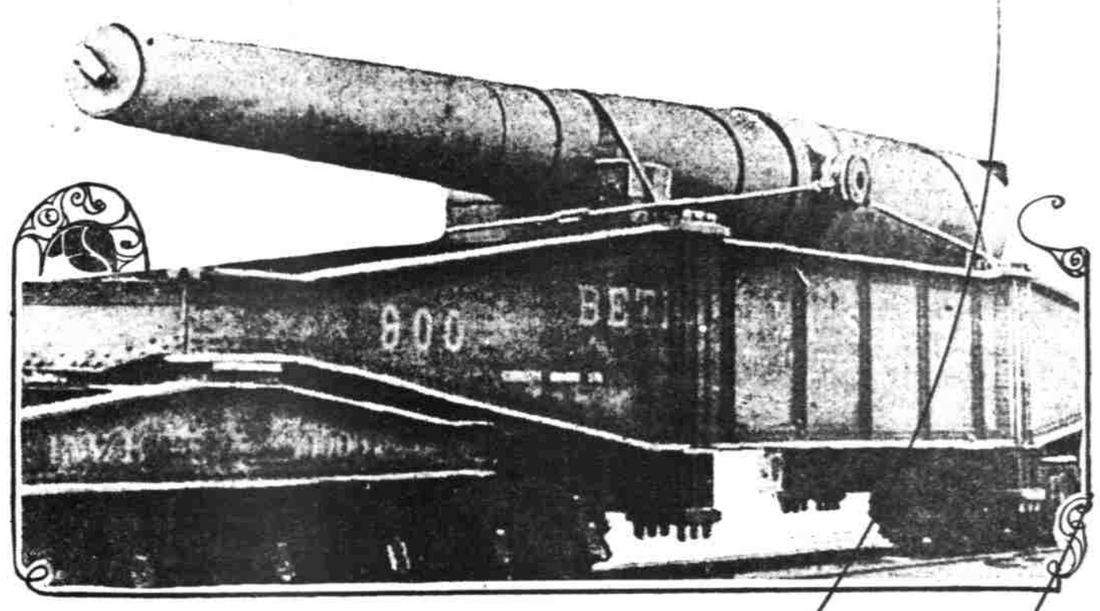
The outer circle shows the caliber of the 42-centimeter (16½ inches) gun used by the Germans in reducing the fortifications at Liege, Namur, Antwerp and other places. This gun is the largest ever constructed. It weights 100 tons, is fifty-nine feet long, and hurls a shell five feet long weighing 1,650 pounds a distance of nine miles. The inner circle shows the caliber of the American 14-inch gun.

The Great German 42-Centimeter Siege Gun



Terrible War Engine Hurls 1650 lb. Shell Nine Miles!

THE NEW AMERICAN 14-INCH GUN



SOME of the Tricks BULLETS Play in BATTLE

IT has been truly said that once you fire a bullet from a modern rifle, no one can forecast where it will ultimately come to rest. Even when a bullet has an uninterrupted course it is capable of upsetting all known calculations of its flight and range.

Before the Battle of Omdurman a sick officer was carried across the Nile and placed under an awning no less than 5,500 yards from the nearest point of possible fire. This should easily have ensured him a margin of safety, but it didn't: a stray bullet ate up the intervening three miles of desert air, struck him in the head and killed him.

Soon before another battle in the Sudan, General Sir Archibald Hunter, Colonel Hacket-Thompson, C. B., and another officer were reconnoitering through an opening in the wall of a disused sakieh, or water-wheel. The hole in the wall was so small that the officers had to stand one behind the other to see anything.

The officer, whose name is not given in the incident, was in front using a pair of binoculars, while Sir Archibald Hunter was in the rear. The glint caused by the setting sun shining on the glass of the binoculars attracted the attention of a Dervish, who, with others, was retiring along the Nile. He stopped, took aim, and fired.

It was a very good shot, for it sped through one of the lenses of the binoculars, through the brain of the officer holding them, killing him on the spot, through the shoulder of Colonel Hacket-Thompson and finally lodged in the breast of Sir Archibald Hunter, where it remains to this day.

LIQUID Fuel for WARSHIPS

FOR some time the British admiralty has been considering the advisability of equipping Britain's dreadnaughts with oil to replace coal for propelling purposes. A number of warships are being driven by liquid fuel and that these experiments have proved to be a success is shown by the fact that of recent months the First Sea Lord has been working on a plan to place oil tanks along the British coast for naval use.

Liquid fuel is burnt by battleships by means of spraying the oil through burners so placed that the flame jets impinge on fire bricks in the boiler furnaces. In this way great heat can be obtained and steam can be got up in a few minutes by turning on a number of taps.

One of the great advantages of oil fuel is that it is cheaper than coal. About sixteen tons of oil generates as much heating power as twenty-five tons of coal. Also liquid fuel can be transferred from one ship to another even in the roughest sea.

The oil can be pumped through a pipe from the supply boat to the ship requiring the fuel.

What England's Monitors are Like

A FEATURE of the combined sea and land battle off Ostend recently was the destructive work of the British "Monitor" battleships, which bombarded the Germans from the shallows off the mainland. The monitor—a word meaning "beware"—is a new form of battleship which is capable of being maneuvered in shallow water in which other vessels would run aground. Whereas a destroyer requires at least ten feet of water in which to move with any degree of safety, the monitor is quite at home in shallows of five feet in depth.

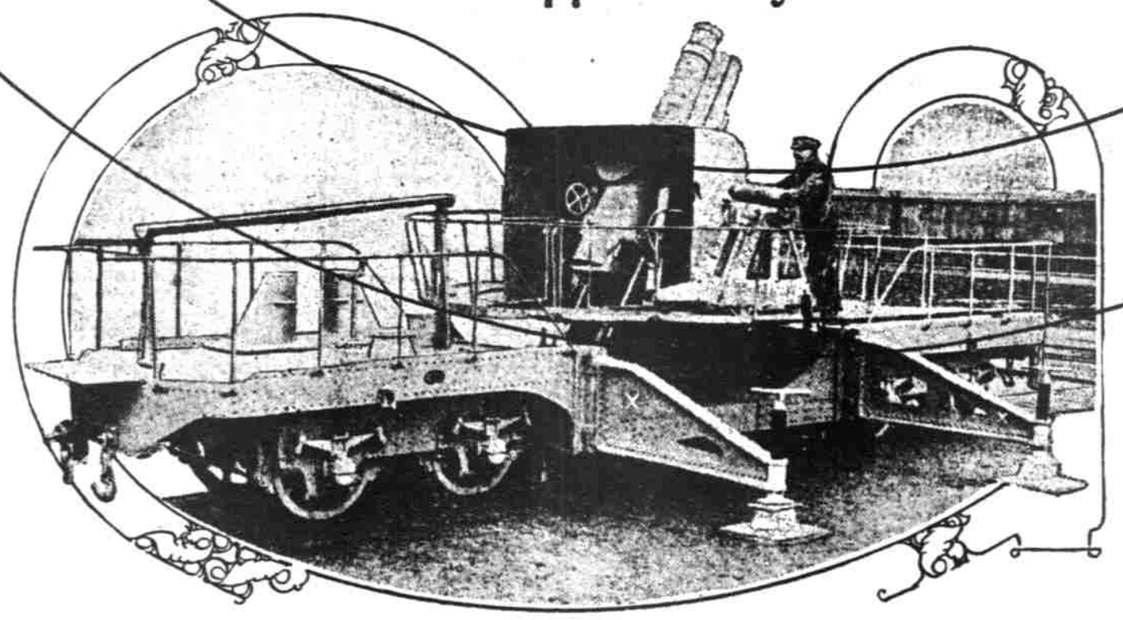
Though heavily armored and carrying a full complement of men, the monitor does not draw more than four and one-half feet of water. The reason for this is that great economy of weight is effected by reducing the size of the engine and boilers in the monitor.

Speed is not an important asset, for the vessel is purely a weapon of offense and defense. The destroyer has engines of 24,000 horse-power to drive her through the sea at twenty-nine knots. The monitor can only travel at eleven knots an hour owing to the fact that her engines, being built for lightness, develop small power.

As a weapon of destruction the monitor is unsurpassed. Possessing two six-inch guns, several three-pounders, and four 7-inch howitzers, these deadly vessels are capable of hurling at an enemy one and a half tons of projectile every minute. Moreover, they present a very difficult target to attacking craft. Being only submerged four and a half feet, torpedoes, which generally travel at a depth of twelve feet below the surface, are likely to pass beneath the hull of the monitor without doing any damage.

The three monitors, the Humber, the Mersey, and the Severn, attached to the British navy, were originally built for cruising amongst the shoals and sandbars of the Amazon, but at the commencement of the war the admiralty took them over from the Brazilian government.

French HOWITZER Supported by STEEL ARMS



HOWITZER batteries which run on railway lines have been constructed for the French government by the Creusot works. The batteries are composed of an observation tower, two howitzers, and the ammunition car, which is placed between them.

The gun carriage on which the howitzer rests is supported by two sets of steel arms (marked with a cross), which may be opened outwards in order to give greater stability to the whole structure when the big 200 mm. howitzer begins firing.

The turntable platform on which the gun immediately rests, and whose operations are controlled, as indeed are all the operations of the movable battery, by just one or two levers, is also built of steel. From the shield behind which the gunner stands and directs his fire the barrel of the howitzer alone protrudes. There are two windows or slits in the shield—one on each side of the gun—through which the gunner can obtain his range and note the result of the firing. The ammunition for the howitzer comes from another part of the train—the ammunition wagon—which, being placed between the two howitzers, conveniently serves both.

How Gigantic Guns Being Used in War Are Made

A FASCINATING sight it is to watch the first stages in the manufacture of the big guns which are proving so formidable and successful in the great war. A solid ingot of steel, some fifty feet in length and weighing about 100 tons, is employed in the making of a 13.5-inch gun.

After being forged and then allowed to cool, so that it may be toughened for the heavy work that has to come later on, this gigantic bar of steel is pressed into cylindrical shape by the most powerful hydraulic press invented, which exerts a pressure of anything between 5,000 and 10,000 tons to the square inch. This machine literally presses the solid steel into circular shape, after which what is known as the trepanning operation is carried out—namely, drilling a large hole—the bore—from end to end, a process which has to be performed with the utmost exactitude. Next the inside of the gun—that is, the bore—is rifled.

The most wonderful sight, however, is the next stage—the hardening process, when the rough weapon is heated to dazzling white-heat and plunged into a huge well full of oil. If the operation takes place in the nighttime, the sight of this huge, glowing bar of metal being lowered apparently into the bowels of the earth, to the accompaniment of leaping tongues of flame given off by the burning oil, may be likened to a scene from Dante's Inferno. The gun is then left to cool in the oil-bath, out of which it comes hardened, toughened, and tempered.

Then follows the wire-winding operation, to make the weapon stronger and impart to it some measure of elasticity. This wire-winding is an operation which is much the same in principle as the whipping on the handle of a cricket bat. In this case, however, the whipping takes the form of strong steel ribbon, which is wound round the body of the gun. Every twelve-inch and 13.5-inch gun actually has about 120 miles of this steel ribbon wound round it.

Many other processes have to be gone through in regard to fitting the gun with mechanism, etc., which it is impossible to give in detail here. Some idea, however, of the labor involved in the manufacture of one of these big guns may be gathered from the fact that from start to finish the time occupied is over twelve months.

Gun Without Recoil

AN officer of the United States navy has invented a gun that fires a 6-lb. projectile without recoil. This gun, because of its absence of recoil, is well adapted to use on aeroplanes or dirigibles.

The gun is most interesting, having both ends open to the atmosphere. The shell has the projectile fitted into one end, and in the other end is a mass of bird-shot. The shot is of sufficient weight to furnish the required reaction when the projectile is discharged from the other end of the gun. When the gun is fired the projectile is thrown from the muzzle at a high velocity while the shot is discharged from the breech at low velocity.

Smashing Power of Modern Bullet

IT IS pointed out by Dr. W. G. Posnett, who was in charge of the surgical wards of a large British general hospital during the Boer war, that the bullet at present in use is somewhat different from those employed in South Africa, being more pointed, with a considerably lower trajectory. It is formed of a shell of hard nickel, filled with lead. Therefore the wounds may be expected to differ as the outer nickel casing will complicate matters. The distance at which the wound is received is of considerable importance.

The wounds Dr. Posnett saw varied greatly, according to whether the persons injured were close to or far from the rifle. It seems the modern rifle bullet has great penetrating power at what one may call the middle distance, from 300 to 900 yards range, and that wounds, even where bones are implicated, received at this distance are of a more penetrative character than those received at a closer or longer range.

The smashing power of a bullet up to 300 yards is considerable, and great smashing of bone is to be expected in wounds received at that distance or under it. The same applies to wounds received at 900 yards or over, where the smashing power of the bullet is again considerable, and bone injuries of the most serious magnitude are inflicted.